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A SURVEY OF MEASURING APPARATUS SHOWN  
AT NINTH ALL-UNION RADIO EXHIBITION

S. Matlin

50X1-HUM

Measuring apparatus of all types constituted 25% of the total number of exhibits at the Ninth All-Union Radio Exhibition. This equipment included standard signal generators, cathode-ray oscilloscopes, vacuum-tube voltmeters, various measuring bridges, audio oscillators, and square-wave generators. In addition, there were capacitance meters, instruments for finding short-circuited turns, comparators, swing-frequency oscillators, wavemeters, and other measuring instruments.

In the measuring apparatus section, there were more volt-ohmmeters, ohm-meters, and multiple-purpose testers than any other type of equipment. Most of these used standard circuits and differed only in certain design features originating in the use of different components. A typical example of this class of equipment is the instrument designed by G. A. Bortnovskiy (Moscow), which can be used to measure low-frequency dc and ac voltages up to 10,000 v, high-frequency (up to 60 Mc) voltages up to 50 v, and resistances from 50  $\Omega$  to 5 M $\Omega$ . A special probe containing a diode detector is used to measure high-frequency voltages. The diode is fed by a dry cell.

Electronic switches, swing-frequency oscillators, and delayed-scanning units are used in most of the oscilloscopes exhibited. Some have cathode followers and paraphase stages. An example of this type of design is V. M. Stolyarov's 13-tube oscilloscope. It has both a continuous and a delayed sweep, which can be used to observe aperiodic processes. The use of a cathode follower and paraphase stages gives the vertical deflection amplifier a pass band of almost 5 Mc. The electronic switch permits simultaneous viewing of two electrical processes. A more complex oscilloscope was designed by K. A. Kingo

- 1 -

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(Tallin). This instrument has four symmetric output amplifiers with strictly identical parameters along the axes X(A) and Y(B), four identical preliminary amplifiers, a variable-frequency oscillator (0-10 kc), a swing-frequency oscillator (100-1,500 kc), and the sweep generator. All amplifiers have a pass band of about 500 kc. A total of 28 tubes are used in the oscilloscope, including a double-gun cathode-ray tube as an indicator.

Two outstanding examples of combined test equipment were the combined standard signal generator and oscilloscope designed by V. L. Mal'tsev (Minsk) and the high-frequency measuring set designed by M. Ts. Stolov (Vil'nyus). In Mal'tsev's set, the standard signal generator has eight subbands, covering frequencies from 100 kc to 30 Mc. Both amplitude and frequency modulation can be used, with three possible frequency swings in the latter, i.e., 5, 10, and 20 kc. Stolov's set contains a standard signal generator, a Q-meter, a cathode voltmeter /VTVM or GES-7, and a superadapter for an oscilloscope. The standard signal generator covers the frequency band from 110 kc to 2 Mc and makes possible modulation of the high-frequency voltage simultaneously or alternately with two frequencies, 50 and 7,000 cps.

Stolov also proposed a novel method for tuning high-frequency systems using his equipment. The superadapter is a transitron oscillator combined with a frequency converter used to extend the band of frequencies which can be studied with an oscilloscope. The main purpose of the adapter is to detect and measure high-frequency oscillations (up to 30 Mc).

Novel exhibits in the miscellaneous class of measuring equipment were the capacitance meter designed by A. A. Teplyakov and the instrument to detect shorted turns designed by L. B. Pis'menny. Teplyakov's instrument will measure capacitances up to 600  $\mu\text{fd}$  with an error of  $\pm 2\%$ . It consists of an rf oscillator, an i-f circuit, and a plate detector; the resonance indicator is a milliammeter connected in the cathode circuit of the detector tube. Pis'menny's instrument permits one to detect shorted turns in rf and af coils and chokes and in the windings of af and power transformers. It has been used in the railroad shop of the Southwest Railroad and has given good results.

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- 2 -

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